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Detectors: X-ray Spectroscopy

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NSSC-LANL Keepin Nonproliferation Science Summer Program
Silicon Drift Detectors: X-ray Spectroscopy

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Chemistry (C)
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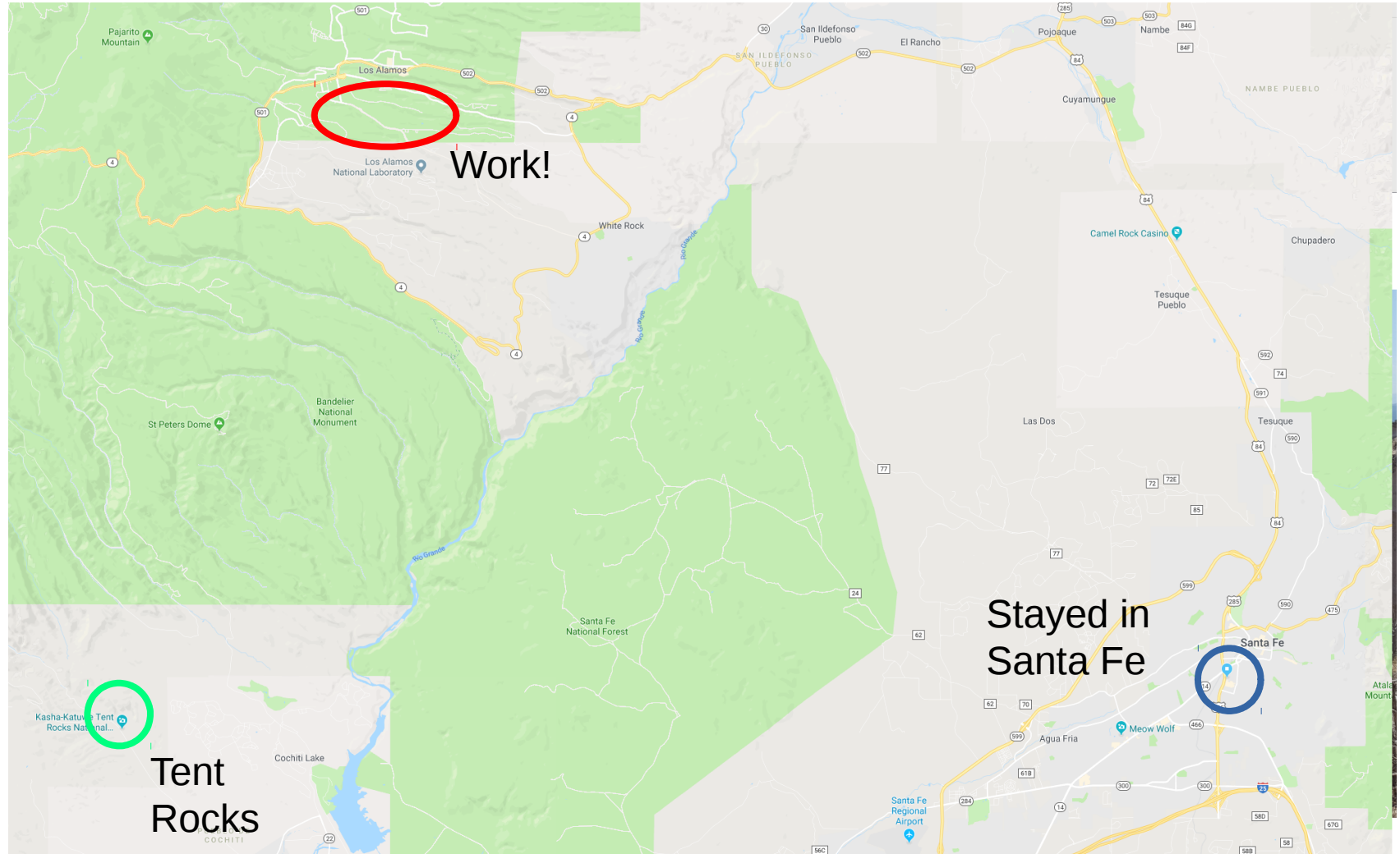
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Chemistry Department

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Kasha-Katuwe Tent Rocks National Monument



Kasha-Katuwe Tent Rocks National Monument

(I went twice!)



James August Ridenour (C-NR)

- Educational Background
 - Dickinson College, BS, 2014
 - The George Washington University, Ph.D., 2020?!
 - Chemistry
- Chemistry Division
 - Nuclear and Radiochemistry Group
 - Mentor: Dr. Robert Rundberg
- Research
 - LANL: X-ray spectroscopy of waste and proliferation relevant radioisotopes
 - GWU: Crystallography and structure-property relationships in fundamental f-element hybrid materials (metals with organics)

THE GEORGE
WASHINGTON
UNIVERSITY

WASHINGTON, DC



August Ridenour



Dr. Rundberg

Research Overview and Motivation

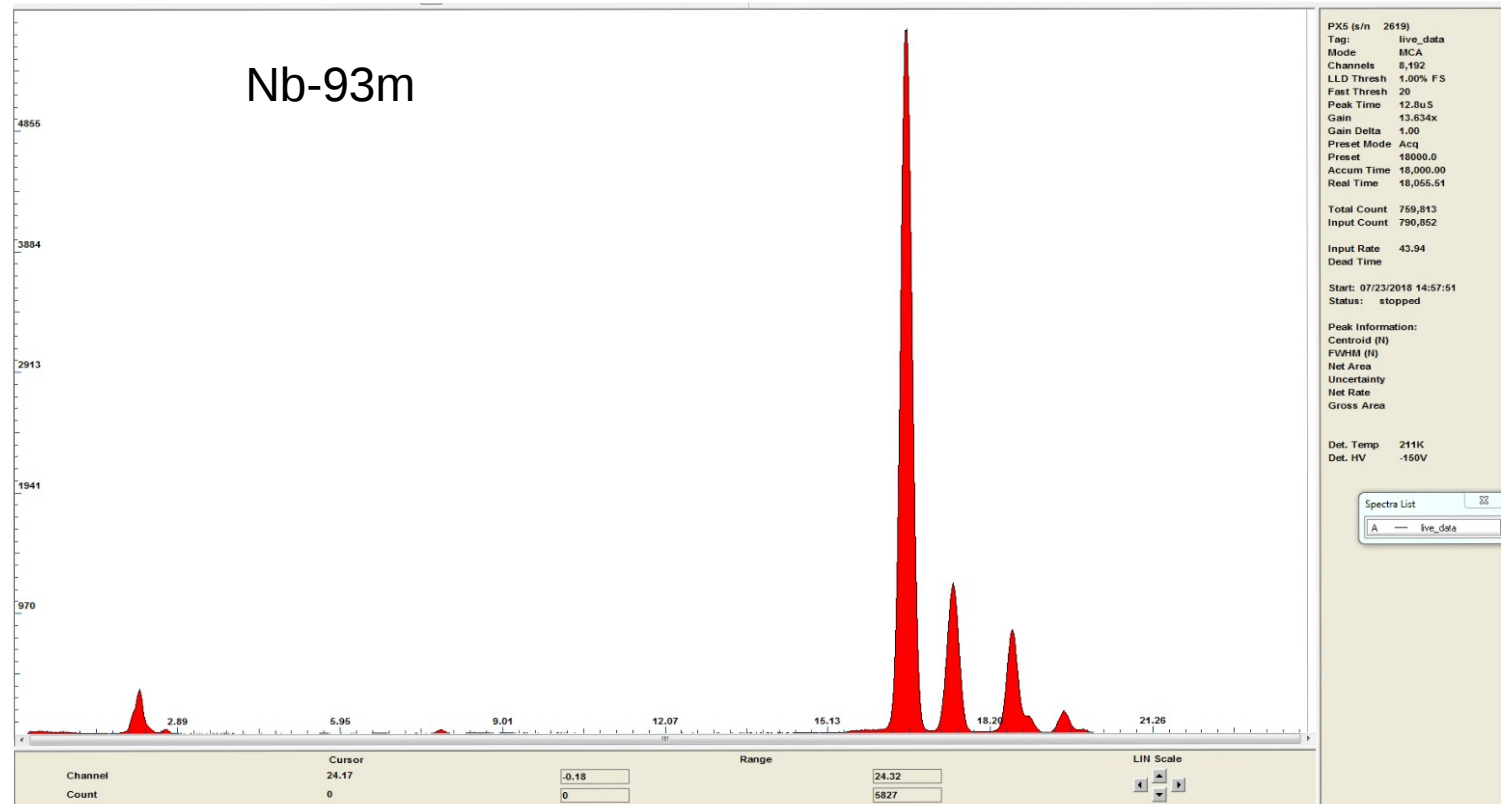
Often, radioisotopes remain excited after an initial radioactive decay and that energy, following swiftly behind, is released as gamma or X-rays.

This inherent physical nuclear property gives analytical scientists an incredibly useful non-destructive tool for detection: discrete, isotope specific packets of ionizing radiation.

The X-rays analyzed are in a very low energy range, but are specific to the daughter elements and are detectable with low voltage Silicon Drift Detectors.

Research Approach

- **Silicon Drift Detectors (SDD)**
 - **Current methods for detecting and differentiating gamma or X-ray radiation from nuclear materials are often done with NaI, HPGe, or CdZnTe (CZT) detectors.**
 - **Both resolution and portability are important parameters for useful detectors.**
 - - NaI and CZT lack good resolution at low energies
 - - HPGe is not portable, requiring liquid nitrogen for cooling
 - **SDD are portable and have good resolution down within the fingerprint region (< 18 keV).**



- Collected on a SDD
- Energies listed are the possible lines observed
- Shoulders and small peaks can be artifacts of the energy interacting with the sample or with silicon

Nb L_{a1} – 2.166 keV (2.0%)

Nb K_{a2} – 16.521 keV (3.30%)

Nb K_{a1} – 16.615 keV (6.29%)

Nb K_{b1} – 18.623 keV (0.96%)

Nb K_{b2} – 18.952 keV (0.201%)